Application of Physical Therapy Techniques to our Canine Patients: The Current Science and Research Opportunities

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“I believe that in the near future, failing to refer a patient for physical therapy will amount to malpractice.”
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H. A. Apfelbach, MD
Director of Orthopedics
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Chicago, IL
What is Veterinary Rehabilitation?

- **Definition:**
- The treatment of physical injury or illness in an animal to decrease pain and restore function.
What is Veterinary Rehabilitation?

- It is NOT all about the Underwater Treadmill…Or the Laser…
EDUCATION

Physical Therapists

• 4-5 year post graduate program

• All graduate with a clinical doctorate degree DPT

• Advanced Certification in clinical specialties
  - Orthopaedics, Neurology, Cardiopulmonary, Sports Medicine

• Animal Rehabilitation Special Interest Group
A ‘New’ Diagnostic Algorithm

- Kent Allen: “In the absence of a diagnosis, Surgery is trauma, Medicine is poison, and Alternative Therapy is witchcraft.”

- The physical therapist’s approach to the patient
  - Emphasis upon soft tissues
  - Special tests allowing determination of specific soft tissue impairments, such as tendinopathies
REHABILITATION APPROACH

- Emphasis on a proper, thorough *soft tissue* diagnosis
- Emphasis on *problem solving*
- Emphasis on creating and meeting goals that are *functional*
REHABILITATION APPROACH

- Majority of therapeutics involve *manual therapies* and problem solving
  - Joint Mobilizations
    - Arthrokinematics VS Osteokinematics
  - Therapeutic exercise
  - Orthotics/Prosthetics
- Modalities
  - Cryotherapy
  - Laser
Classifications of Research for EBM

• Top Tier: Meta-analysis of RCT clinical trials (Cochrane Systematic Reviews)
• Second tier: Randomized, placebo-controlled, double-blinded studies
• Third tier:  
  • Physiological Basic-Science Studies
  • Laboratory Based efficacy studies
• Fourth tier: Clinical Case Studies
Defining the Amount of Science Behind a Treatment: Vet Med

- Standard is Randomized, Placebo-controlled, Double Blinded Trials
- Cochrane-style reviews are rare in veterinary medicine
  - Lack of adequate numbers (no studies would be found adequate)
- Pharmacological (and possibly surgical) research is limited enough in scope to derive meaningful data with small group numbers
Parachute use to prevent death and major trauma related to gravitational challenge: systematic review of randomized controlled trials

(Smith GC, Prell JP; 2003)

What we already know about this topic:
- Parachutes are widely used to prevent death and major injury after gravitational challenge

What this study adds:
- No randomized controlled studies of parachute use have been undertaken
- The basis for parachute use is purely observational and any apparent efficacy could potentially be explained by a “healthy cohort” effect
Example: Canine Osteoarthritis

- **Surgical treatments**
  - Imbrication technique
  - Tightrope technique
  - TPLO
  - TTA

- **Medical approaches**
  - NSAIDs
  - Supplements
  - Adequan
  - Weight loss

- **Physical Medicine**
  - Acupuncture
  - Laser
  - Shock wave
  - TENS
  - Therapeutic ultrasound
  - Therapeutic exercises
  - Hydrotherapy
  - Thermotherapy
  - Massage
Systematic review of the management of canine osteoarthritis


- Review of 68 publications 1985-2007
- Considered:
  - 4 alternative therapies
  - 1 functional diet
  - 2 intra-articular products
  - 6 nutraceuticals
  - 21 pharmacologic products
  - 2 physical therapy techniques
  - 3 surgical procedures
  - 2 weight loss programs
Systematic review of the management of canine osteoarthritis

- **Strong to moderate evidence** of efficacy for 4 NSAID’s to control pain
- **Moderate evidence** for efficacy of 3 nutraceuticals and the functional diet for modification of structures related to the disease
- **Weak to no evidence** to support the use of doxycycline, electro-acupuncture, 2 intra-articular agents, or TPLO
Evaluation of fibular head transposition, lateral fabellar suture, and conservative treatment of cranial cruciate ligament rupture in large dogs: a retrospective study. Chauvet AE, Johnson AL, Pijanowski GJ

- Thirty dogs
  - No differences between treatment groups’ age, sex, or time until diagnosis

- No differences in scores for lameness, stifle instability, or force plate analysis among the treatment groups

- Radiographically, degenerative joint disease progressed or remained severe regardless of treatment
Applications of evidence-based medicine: cranial cruciate ligament injury repair in the dog

Aragon CL, Budsberg SC.

“At this time, there is not a single surgical procedure that has enough data to recommend that it can consistently return dogs to normal function after CCL injury.”

An evidence-based medicine paradigm did not provide sufficient evidence favoring one surgical technique for management of canine CCL injury.
Comparison of short- and long-term function and radiographic osteoarthrosis in dogs after postoperative physical rehabilitation and tibial plateau leveling osteotomy or lateral fabellar suture stabilization

Au KK, Gordon-Evans WJ, Dunning D

No significant difference in ground reaction forces or radiographic OA scores between dogs with CrCL injury treated with LFS or TPLO

- LFS and TPLO remain good options for stabilizing stifles with CrCL injury with all dogs showing significant functional improvement. This study does not support the superiority of either surgical technique.
Surgical versus conservative interventions for anterior cruciate ligament ruptures in adults
Linko E, Harilainen A, Malmivaara A

Anterior cruciate ligament rupture is a common knee injury. Surgical treatment, usually involving reconstruction of the ligament, is widely used especially in active individuals

- There is insufficient evidence from randomised trials to determine whether surgery or conservative management was best for ACL injury in the 1980s, and no evidence to inform current practice
At present it is not demonstrated that ACL-plasty can prevent osteoarthritis.

Studies comparing surgical and conservative treatments confirm that ACL reconstruction is not the prerequisite for returning to sporting activities.

More recent and scientifically well-designed studies demonstrate that conservative treatment could give satisfactory results for many patients.
CONCLUSION: At present there are no evidence-based arguments to recommend a systematic surgical reconstruction to any patient who tore his ACL. Knee stability can be improved not only by surgery but also by neuromuscular rehabilitation.
Short-term and long-term outcomes for overweight dogs with cranial cruciate ligament rupture treated surgically or nonsurgically

Wucherer KL, Conzemius MG, Evans R, Wilke VL

- 40 client-owned overweight dogs with unilateral CCLR
- Randomized into nonsurgical vs. surgical groups
- Nonsurgical Tx=rehabilitation, weight loss, NSAIDs
- Surgical dogs had TPLO plus the ‘nonsurgical’ tx
- 2/3 of the nonsurgical dogs had successful outcomes at 1 year
Fusion is no more effective than intensive rehabilitation, and only slightly to moderately more effective than non-intensive therapy.

Surgical disk removal is moderately superior for 2-3 months, but after that the two groups are similar in many studies.

Laminectomy for spinal stenosis is moderately superior to non-surgical therapy for 1-2 years only.
IVDD Treatment Recommendations in Current Veterinary Literature

- Prevailing wisdom:

- Variety of surgical options with varying prognoses and recurrence

- Severe pain, severe neurological deficits, recurrence or deterioration of clinical signs: surgery recommended

- Debate as to timing of surgical intervention
IVDD Treatment
Recommendations in Current Veterinary Literature

“Conservative management is usually reserved for cases with recent-onset mild myelopathy or paraspinal hyperesthesia.”

Compendium, Mar 2009
What Did Compendium Reference?

• 1956, Hoerlein: Further evaluation of the treatment of disc protrusion paraplegia in the dog

• 1962, Funkquist: Thoraco-lumbar disk protrusion w/ severe cord compression in the dog; clinical observations w/ special reference to the prognosis in conservative treatment.

• 1965, Wilcox: Conservative treatment of thoracolumbar IVDD in the dog.

    CT: strict cage rest and Vitamin B complex

• 1970: Funkquist: Decompressive laminectomy in T-L disc protrusion w/ paraplegia in the dog.

• 1989: Scavelli: Problems and complications associated with the nonsurgical management of IVDD.
IVDD Treatment Recommendations in Current Veterinary Literature

“\textit{It is well accepted that conservative management is not appropriate for dogs that have lost DPP.}”

VCNA-SAP, Sep 2010


CT = “confined to a small cage for 14 days when possible under veterinary supervision; corticosteroids routinely employed”
Recommendations in Current Veterinary Literature

- “Non-ambulatory dogs with disk herniation are best managed by surgical intervention... medical therapy may still be effective in some cases.”

- Used an un-validated 12-question, questionnaire
- Lacked a definitive diagnosis in most dogs
- “medical management” was NSAIDs or steroids and cage rest
Majority of opinions have ignored the extreme evolution of “conservative therapy”
“New” Thoughts on IVDD in The Literature

Jadeson; JAVMA, April 1961 - PT treatment

Fig. 1—Infrared and ultrasonic therapy consisting of mild heat treatment followed by paravertebral sonation of thoracolumbar region.

Fig. 2—Electrical stimulation is given to muscles of the back of a Dachshund.

Fig. 6—Carriage for partially recovered dog is designed to give support during gait training.
"New" thoughts on IVDD in literature

- Jadeson: Human Physical Therapist
- 82 dogs with hind limb paresis or paralysis (~grade 3-5) of no more than 4 days duration
- Success was improvement to grade 1-2
  - 90%
  - Relapse w/in 1 year was 4%.
“New” Thoughts on IVDD in The Literature

- Jadeson used nursing care, muscle relaxants, thermotherapy, massage, exercises and stretching, electrical stimulation, and ultrasonic therapy.

- Conclusion: “one single measure is often insufficient to bring about a significant improvement, and it takes the combination of several modalities supporting each other to achieve functional restoration and optimal recovery.”
1961: Why was this ignored?

Hoerlein – founding father of vet neurology and IVDD therapy – commented on Jadeson’s results.

In some respects, Jadeson’s results appear to be very good. One must remember that Jadeson is a registered physical therapist, apparently of unusual ability. The work was done in partial fulfillment of requirements for the Master of Science degree, so that it is certain that the patients received unusually fine care. Jadeson’s methods were highly developed, and such equipment as an ultrasonic appliance, a diathermy machine, muscle stimulators, and carriages was available. Few practitioners could hope to achieve this degree of success with physical therapy. The results summarized in

Hoerlein, 1978
The “New” ‘Conservative Management’

- **Flexible:**
  - Adjunct to Surgery
  - Follow-up to unsuccessful surgery
  - Stand-alone (without surgery)

- **Successful:**
  - Estimate 90-95% of patients return to grade 1-2

- **Expense:**
  - Less immediate, but long ongoing investment.
  - Requires invested owner, regardless of finances
REHABILITATION APPROACH

- Majority of therapeutics involve *manual therapies* and problem solving
  - Joint Mobilizations
    - Arthrokinematics VS Osteokinematics
  - Therapeutic exercise
  - Orthotics/Prosthetics
  - Modalities
    - Cryotherapy
    - ESWT
    - Laser
THERAPEUTIC EXERCISE EQUIPMENT LIST

- PHYSIOBALLS
- THERABANDS
- ROCKER BOARDS
- CAVALETTI POLES
- TREADMILL
What Do We Know About Therapeutic Exercise in Dogs?

- Epaxial muscle function in trotting dogs
  - Dale A. Ritter, Peter N. Nassar, Mathew Fife and David R. Carrier
    Biology Department, Heidelberg College, Tiffin, OH; Department of Geology, Bryn Mawr College, Bryn Mawr, PA and Department of Biology, University of Utah, Salt Lake City, Utah
  - The epaxial muscles appear to counteract the tendency of the trunk to rebound (flex) in the sagittal plane during the latter half of the support phase.
What Do We Know About Therapeutic Exercise in Dogs?

Locomotor function of forelimb protractor and retractor muscles of dogs: evidence of strut-like behavior at the shoulder

- David R. Carrier1,*, Stephen M. Deban2 and Timna Fischbein1

1Department of Biology, University of Utah, Salt Lake City, UT 2Department of Biology, University of South Florida, Tampa, FL

The Journal of Experimental Biology 211, 150-162. Published by The Company of Biologists 2008

- Implanted electrodes to evaluate muscle function in shoulders during trot on treadmills
The Next Step

- Can surface EMG’s produce the same results?
- Can we use this method clinically?
- We know exercises that work in human ACL rehabilitation to help to stabilize the knee
  - We hypothesize that these same exercises could help our canine patients
  - We need to be able to show how therapeutic exercises affect specific muscles
What Do We Need to Learn?

- Conservative treatment of CrCL does not change the instability of the joint, but an animal may still achieve a high level of function with an unstable joint.

- Force plate might still show an abnormality, but the functional score could show improvement.

- We need to create functional scoring systems.
  - Currently underway at CSU.
What Do We Need to Learn?

• Kinematic Gait Analysis Systems
  • The Gold Standard today

• Limitations:
  • Tremendous breed variation and variation between individuals of the same breed
  • Significantly limits comparisons between studies
  • Accurate placement of markers is difficult
  • Skin movement adds error
What is on the Horizon?

- Accelerometer Systems
  - More securely attached
  - Provide additional information over kinematics
  - Currently used in feline research
  - Prototype system in review at CSU
Veterinary Orthotics and Prosthetics (V-OP)
Gastrocnemius Tendon Strain in a Dog Treated with Autologous Mesenchymal Stem Cells and a Custom Orthosis
Veterinary Surgery 2013

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Case Report:

- Bone-marrow derived, autologous mesenchymal stem cells transplanted into core lesion
- Custom, progressive, dynamic orthosis applied
- Objective motion control
IN CONCLUSION

- Veterinarians need to become better informed as to the art and science of physical rehabilitation to offer this service to our clients.
- We need evidence based medicine to validate the use of human physical therapy techniques and modalities on our canine patients.
- The public expects state-of-the-art care for their canine companions, including appropriate rehabilitation from injuries and illnesses.
THANK YOU!

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